

## **REMARKS**

### **INTRODUCTION**

In accordance with the foregoing, claim 11 has been cancelled. Claims 1-10 are pending and under consideration.

### **OBJECTION TO THE DRAWINGS**

The drawings were objected to for failing to accurately convey the material disclosed in the specification. Specifically, it was noted that Figure 5 shows vertical motion vector calculation part 200 as taking input from first frame 110 only. It is respectfully submitted that the arrow leading into the vertical pixel value storage is from both the first frame 110 and the second frame 120 and that Figure 5 is consistent with paragraph [0034] of the specification.

Withdrawal of the foregoing objection is requested.

### **CLAIM REJECTIONS**

Claims 8 and 11 were rejected under 35 USC 103(a) as being unpatentable over Yamauchi (US 6,072,833) (hereinafter "Yamauchi").

Claims 1-10 were rejected under 35 USC 103(a) as being unpatentable over "VLSI Architecture for Block-Matching Motion Estimation Algorithm," Chaur-Heh Hsieh and Ting-Pang Lin, IEEE Transaction on circuits and Systems for Video Technology, Vol. 2, No. 2, June 1992, pages 169-175 (hereinafter "Hsieh") in view of Yamauchi.

Claim 1 was rejected under 35 USC 103(a) as being unpatentable over Yamauchi in view of Yokoyama et al. (US 6,078,618) (hereinafter "Yokoyama").

#### **Claims 1-7**

Claim 1 recites: "...an offset control part which decides vertical reference positions when calculating horizontal motion vectors of the second frame according to the vertical motion vectors; and a horizontal motion vector calculation part which calculates the horizontal motion vectors of the second frame in lines according to the vertical reference positions." In the Office Action, claim 1 was rejected on two separate grounds of obviousness. The first, on page 5, item 4 of the Office Action, was that claim 1 is obvious over Hsieh in view of Yamauchi. The second, on page 13, item 5 of the Office Action, was that claim 1 is obvious over Yamauchi in view of Yokoyama.

Regarding the rejection based on Hsieh in view of Yamauchi, the Office Action states (on page 11, line 17) that Hsieh teaches a system that does not break down motion vectors into independent vertical motion vectors and horizontal motion vectors dependent on vertical reference positions. The Office Action relies on Yamauchi to supply this deficiency in Hsieh. In Yamauchi, when a true motion vector is sought for a block to be detected, or a target block ( $m1$ ,  $n1$ ), the optimum motion vector is selected from among the motion vectors previously detected, and the selected motion vector is rendered as an initial vector  $V0\{=(\alpha0, \beta0)\}$ . Then, using the iterative gradient method, a motion shift vector  $V1\{=(\alpha1, \beta1)\}$  is sought based on the block ( $m1 + \alpha0$ ,  $n1 + \beta0$ ) at which the coordinates are shifted by a magnitude of the initial vector and based on the target block. A true motion vector  $V\{=V0+V1\}$  for the target block is sought by adding the initial vector  $V0$  and the motion shift vector  $V1$ . By contrast, claim 1 recites a horizontal motion vector calculation part that calculates the horizontal motion vectors of the second frame in lines according to the vertical reference positions. In Yamauchi, the motion shift vector  $V1\{=(\alpha1, \beta1)\}$  is sought based on the block ( $m1 + \alpha0$ ,  $n1 + \beta0$ ) which combines the horizontal and vertical motions vectors together without a vertical reference position.

The Office Action further relies on Figure 8 of Yamauchi. The Office Action admits that Yamauchi does not discuss that horizontal motion vectors are used as shift vectors on page 5, line 5. The section of Yamauchi relied on by the Examiner, the second embodiment of Yamauchi, notes that although an initial vector is selected based on the magnitude of the vertical motion vector of the prospective initial vector, it is also possible to select, where vertical motion vectors are detected using an interfield signal and an interframe signal, respectively, either of motion vectors, depending on whether the magnitude of the detected motion vector is greater or less than the predetermined threshold. This feature of Yamauchi is cited to disclose improved accuracy in motion vector estimation. However, Yamauchi does not discuss that the horizontal motion vectors of the second frame are calculated in lines according to the vertical reference positions as recited in claim 1. It is well settled that an invention is not obvious where the prior art only provides an "invitation to explore" even though the prior art could theoretically explain an invention. See *Ex Parte Obukowicz*, 27 USPQ2d 1063 (B.P.A.I. 1992). The statement in the Office Action on page 5, line 11 that "[i]f vertical motion vectors can be used as 'initial vectors', then horizontal motion vectors, in turn, can be used as 'shift vectors', and their addition would produce the 'true motion vector' seems to be both adding features to the disclosure of Yamauchi and further using the apparatus of claim 1 as a template to improve the teachings of the prior art. See *Lear Siegler, Inc. v. Aeroquip Corp.*, 733 F.2d 881, 221 USPQ 1025 (Fed.

Cir. 1984). As such, it is respectfully submitted that claim 1 is not obvious over Hsieh in view of Yamauchi.

Regarding the rejection of claim 1 based on Yamauchi in view of Yokoyama, the Examiner relies on Yokoyama to provide the offset control part which decides vertical reference positions when calculating horizontal motion vectors of the second frame according to the vertical motion vectors recited in claim 1. However, in Yokoyama, a final motion vector value is calculated by means of adders 210 and 211 which add offset values to the horizontal and vertical component values, respectively, the offset values which are selected by selectors 208 and 209, respectively, according to offset designations which are respectively supplied from the horizontal and vertical offset control sections 206 and 207, which will set new offset values for searching the next motion vector according to the output of the minimum value detecting section 205. Although Yokoyama discusses horizontal and vertical offset control sections 206 and 207, neither of the horizontal and vertical offset control sections 206 and 207 are discussed as deciding reference positions when calculating one component of the motion vector of the second frame as recited in claim 1. As such, it is respectfully submitted that claim 1 is not obvious over Yamauchi in view of Yokoyama.

The apparatus of claim 1 can calculate motion vectors at a high speed compared to the cited prior art by calculating vertical motion vectors first and reducing calculation amounts of horizontal motion vectors based on the vertical motion vector calculations.

Claims 2-7 depend on claim 1 and are therefore believed to be allowable for at least the foregoing reasons.

Withdrawal of the foregoing rejection is requested.

#### **Claims 8-10**

Claim 8 recites: "...deciding vertical reference positions when calculating horizontal motion vectors of the second frame according to the vertical motion vectors; and calculating the horizontal motion vectors of the second frame in lines according to the vertical reference positions." In the Office Action, claim 8 was rejected on two separate grounds of obviousness. The first, on page 3, item 3 of the Office Action, was that claim 8 is obvious over Yamauchi. The second, on page 5, item 4 of the Office Action, was that claim 8 is obvious over Hsieh in view of Yamauchi.

As both the obviousness rejections were based on Yamauchi, and as the Office Action notes that Yamauchi does not teach calculating the horizontal motion vectors of the second

frame in lines according to the vertical reference positions, it is respectfully submitted that claim 8 patentably distinguishes over Hsieh and Yamauchi.

Claims 9 and 10 depend on claim 8 and are therefore believed to be allowable for at least the foregoing reason.

Withdrawal of the foregoing rejection is requested.

**Claim 11**

Claim 11 has been cancelled.

**CONCLUSION**

There being no further outstanding objections or rejections, it is submitted that the application is in condition for allowance. An early action to that effect is courteously solicited.

Finally, if there are any formal matters remaining after this response, the Examiner is requested to telephone the undersigned to attend to these matters.

If there are any additional fees associated with filing of this Amendment, please charge the same to our Deposit Account No. 19-3935.

Respectfully submitted,

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